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THE FIRST GERMAN MUNICIPAL EXPOSITION.

(DRESDEN, 1903.)

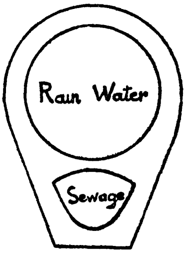
III.

E. PUBLIC HEALTH AND SAFETY.—*Continued.*

Sewerage.—Because technically connected with the same municipal department as streets, the subject "sewerage" was placed under the general head "traffic" in the official catalogue of the exposition. The discussion of this subject, however, belongs logically here.

1. *Types of sewers.*—The ordinary sewers are either circular or egg-shaped with the small end downward. The latter is the more modern form. Having the smaller end downward effects a bringing together of the contents of the sewer when the stream flowing through it is small, and insures a current. The best modern sewers, however, are of the double-conduit type—adapted to the modern system of purifying sewage before discharging it into the rivers. When conditions are such that the sewage may be allowed to flow directly into a river, without purification, the former types of sewer suffice; but when, as is usually the case, further treatment of the sewage is necessary, the double-conduit system commends itself. By this latter system sewage and drainage are separated. The rain-water is led directly to the point of discharge. It may be noted here, however, that in Bielefeld, the central point of the Westphalian linen trade, even the drainage water is cleared before being discharged into the river; for the water of the latter is used by the bleaching establishments. The sewage, on the contrary, kept separate by the construction of the sewers, is led to the purifying plants. There is an extra cost of sewer construction, but a saving in cost and operation of the purifying plants, as there is not so great an amount of sewage to be treated. The two sewer pipes may be laid separately, or may be combined in a double pipe. Kiel is converting her system to the double-conduit system, but will use

the existing sewers for drainage purposes, building a new system for sewerage. Aachen and Königsberg are evidently in a transition state, for part of their respective systems is of the old type, and part is of the double-conduit type. The newly built sewer systems consist, not of two sets of pipes, but of single sets of double-pipe sewers. The upper pipe is built large enough to drain the streets readily, even after excessive rainfall. The lower pipe is smaller, serving for sewage, the amount of which is small and not subject to great variation. An example of this type was exhibited by Bromberg.



The *material* for the great trunk sewers is usually pressed cement or bricks. The other sewers are usually built of pressed cement with a dressing of tile plates along the bottom. This surface is glossy, non-absorbent, and is not susceptible to acids as is the cement. The pressed-cement construction is well adapted to the double-pipe system. The exhibit of the manufacturing firms made in this section of the exposition was especially good. It formed an able supplement to the exhibit of the municipalities.

Almost every municipality exhibiting in this section showed its well-developed network of sewers. Schöneberg has a new system—a unified circulation system. It has hygienic and technical advantages over the ramified system, in that it does not have the great number of *Gipfelpunkten*, with their foul exhalations, and admits of effective flushing and of circulation of air through the whole network. Halle combines a groundwater drain with her trunk sewer.

2. *Accessories.*—Street drainage is freed of mud and coarse materials before entering the sewers, by means of *gullies*, as exhibited by Berlin, or by means of removable *buckets* hung in the gullies, as exhibited by Wiesbaden, Leipzig, and Dresden (*cf.* illustration[1]). The former have to be scraped and cleaned; the latter are removed, emptied into wagons, and replaced. In either case the cleaning is thorough and frequent. Where the sludge

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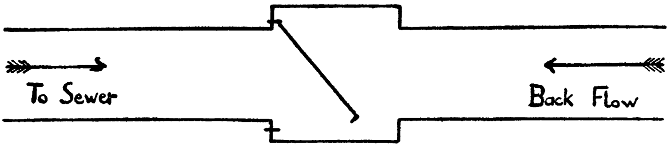
[1] Vol. IX, opposite pp. 626 and 628.

buckets are used the escape of gases from the sewer is prevented by *odor traps* (*cf.* illustration[1]). For *ventilation* of the network of sewers, Frankfurt has adapted four old watchtowers. Among the various interesting drawings and models of sewer accessories exhibited by Wiesbaden were several types of *manholes* and shafts. One of the exhibiting firms presented an *automatic trap* for use with single-conduit sewers to prevent sewage from "backing up" and flooding cellars in time of excessive rainfall. Dresden exhibited sewer-gates for closing the mouth of the sewer in times of high-water level in the Elbe.

3. *Cleaning of sewers.*—The sewers are generally cleaned by flushing, the main differences being in the apparatus which causes the expulsive rush of water which washes the sewer. The best exhibits of such appliances were full-sized objects in operation, shown by the industrial firms which supply the municipalities therewith. The simplest of these appliances, especially adapted to the single-pipe sewer, is a *gate*—either controllable or automatic—across the lower half, or two-thirds, of the sewer pipe. This holds back the contents of the sewer until a great volume has accumulated. The sudden release, caused by the opening of the gate, permits a rush of the sewage, which carries with it even the heavier materials along the bottom. A second form is a *movable dam*, for large, walled sewers—exhibited by Berlin—which is almost the size of the cross-section of the sewer. At the bottom is a comparatively small opening. The sewage, dammed back except at that point, rushes through, carrying with it the sand and similar deposits along the bottom. A third kind of flushing apparatus is a *reservoir* with automatic siphon discharge, at regular intervals. The chamber of the reservoir is filled by means of a stream of water (from the ordinary water pipes). When the reservoir is full, discharge through the siphon takes



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[1] *Ibid.*

place. The intervals of discharge may be regulated by the size of the stream of water which fills the reservoir. A fourth appliance is a *tipping tank.* A stream of water, which may be regulated, flows into an eccentrically balanced tank until, when full, the tank is unbalanced and tips, emptying itself instantly. When empty, the tank rights itself and the process is repeated. In the double-pipe system the rain-water sewer keeps itself clean, but the sewage pipe must be thoroughly cleaned because of the concentration of its contents. To flush this lower pipe the entrance *shaft is filled* with water from a nearby sprinkling hydrant. The water is then suddenly released into the sewer. Further cleansing is accomplished by drawing stiff *brushes*, the shape and size of the cross-section of the sewer pipe, through the sewer, from one manhole to the next.

4. *Machinery and appliances.*—In connection with the removal and purification of sewage a great deal of machinery of various kinds is necessary. In some cases the natural fall is sufficient, as, for example, Dortmund. In Köngisberg a part of the sewage is thus removed, but the rest must be pumped away. A model of a plant with engines, boilers, and steam pumps was exhibited by Berlin. Mannheim, to mention one more example, in order to collect the sewage for purification, has had to lay long stretches of *Düker*, and has to pump part of the sewage three times. The *Düker* are iron pipes for carrying sewage under rivers to the other side. Thus Breslau has laid such pipes under the river Oder, and Cassel under the Fulda. A further use of *Düker* is for discharging sewage in mid-stream. The classical example is, of course, Hamburg; but Düsseldorf uses the same means for discharging sewage into the Rhine.

2. *Purification of sewage.*—The several methods of purifying sewage, as practiced by the German municipalities, are: *settling* (*e. g.*, sand); *skimming*—for floating materials (*e. g.*, paper, wood); *precipitation*, (*a*) mechanical, (*b*) chemical—for matter in suspension; *biological purification*—for organic matter; and *filtration*—for the most complete purification. It may be repeated here that the *gullies* and *buckets*, mentioned above, perform the first step in the treatment of sewage.

The *settling-room* bears a similar relation to a sewer, that a lake does to a river. It is a large chamber whose bottom is much below the sewer, but whose outlet is at the same level as that of the sewer. The stream of sewage, flowing into a quiet body of water, loses its current, and consequently its carrying power, dropping all heavy materials. Chain buckets collect this deposit, raising it to the street level, whence it may be carted away. Hamburg, Magdeburg, and Frankfurt a. M. exhibited notably good models of settling-rooms and chain buckets.

Skimmers are large iron sieves or gratings which catch and hold back all larger floating objects, as the sewage passes through them. They are placed at the outlet of the settling-rooms. Self-cleaning skimmers of two kinds were shown. The Frankfurt model is a wheel-like arrangement. An automatic brush-work brushes the material caught in the large arms onto an endless belt. The Hamburg model is an endless belt of iron grating, with buckets at intervals, placed at right angles to the outflowing stream. The buckets empty themselves at the top.

Sewage usually receives this much treatment, whether or not any further purification follows. Hamburg, after such treatment, simply discharges its sewage, through three six-foot *Düker*, into the Elbe. Cöln *dilutes* its sewage two and one-half fold. Bacteriological examinations of the water, above and below the city, prove that such dilution is sufficient, as the swiftly flowing Rhine purifies itself rapidly. Dresden insists upon a quintuple dilution — by means of an intercepting canal — before allowing the sewage to flow into the Elbe, and is planning for a purification plant to replace this treatment.

The so-called *mechanical precipitation* consists in allowing the sewage to stand, undisturbed for some time, in subsidence basins. Suspended material of positive specific gravity sinks to the bottom. Here it is collected at points of maximal depth, whence suction pumps remove it. Among other exhibits were: the drawings for a mechanical precipitation plant to be built by Hannover at a cost of 1,500,000 marks; and a model of the plant at Frankfurt a. M. After having studied the various systems of sewage purification, to see if they were adapted to the needs and conditions of Frankfurt, the authorities decided upon rebuilding and enlarging their old plant without altering the system.

Chemical precipitation is similar to the mechanical, except that chemicals, such as lime, aluminium sulphate, and iron sulphate, are introduced to accelerate and further the precipitation. Leipzig, Halle, and others presented this method.

Biological purification is accomplished by permitting the various organisms in the sewage to annihilate each other, and thus make the water harmless. The plan is still in its infancy, and in its present state of development is too expensive for the purification of great quantities of sewage. The soundness and practicability of the method were shown by the exhibit of a manufacturing firm, presenting a purifying plant in operation. Live gold fish were kept in the cleared fluid during the Exposition. Aachen showed plans for a new plant, costing 25,000 marks, where the method is to be tested. What future results will be brought forth cannot, of course, be foreseen.

Filtration is accomplished by using the sewage for irrigating (and fertilizing) specially prepared fields. The water sinks into the ground, leaving therein its foreign contents, which act as fertilizer. As the land selected is usually poor, sandy soil, the enrichment thereof is a distinct gain, and the water, which is drained off from the fields, has been purified by the process. Filtration by means of sewage farms affords the most complete available purification for sewage; but certain conditions are necessary. A large tract of land is required; according to German experience, the area should approximate that of the—rather compact—city to be served. The farms must be near the city, in order that the sewage need not be piped great distances; and yet they must not be so near as to interfere with the spreading growth of the city. The land must be level, or only slightly sloping; and the soil must be light above, and percolable below—preferably, sandy topsoil and gravelly subsoil. The *Rieselfelder* of Charlottenburg (near Berlin) lie, relatively, so high that the drainage from them raises the ground water level and floods lower fields. To counteract this, Charlottenburg has to drain away the ground water. In spite of the many conditions necessary for sewage farms, they have been adopted by many of the German municipalities. Berlin, Breslau, and Dortmund exhibited models of their *Rieselfelder*, and plans and drawings were exhibited by Magdeburg, Königsberg, Liegnitz, and Münster.

In preparing the sewage farms, the land must be built into "rolling" fields. Large canals with smaller branches lead the sewage to various parts of the fields. The water led to the fields is a murky but inoffensive effluent; it has already been somewhat purified by the settling and skimming processes, and sometimes has been purified in subsidence basins—as, for example, in Dortmund, and in Cottbus, where it is treated by both the mechanical and the chemical processes. The sewage is led along the ridges in the fields. A drainage system of underground pipes collects the water after it has sunk into the soil, and leads it, now purified, to the ditches which alternate with the ridges. The ditches empty into some nearby stream. The greatest question with regard to the operation of the sewage farms presents itself in the rainy season. The fields are already saturated, and the draining streams are full; yet an increased amount of fluid must be cared for. The adoption of the double-conduit system of sewers seems to be a solution of this problem. Frosty weather presents no insurmountable difficulties, for the freezing-point of the sewage is low, and there is no drainage water in the sewers. It should be remembered, for the sake of comparison, however, that the climate of Germany is much milder than that of our northern states.

Usually the land is owned by the municipality, and the farms are rented. In Königsberg the land is owned privately. Dortmund established her sewage farms in 1898. She paid 1,500,000 marks for the land, 1,000,000 for pipes leading to the fields, and 4,000,000 for ditching and draining of the fields.

6. *Utilization of the sludge.*—The material precipitated in the process of purification may be buried in trenches to serve as fertilizer, or dried, by heat or centrifugal process, pressed into cakes, and sold or given away. The cakes may be used for (*a*) fertilizer, (*b*) fuel, (*c*) humus for making gas (*e. g.*, the Dietz process of mixing with brown coal, as exhibited), or (*d*) the

grease contained in it may be extracted and refined, according to the process exhibited by Cassel.

Street-cleaning and garbage removal.—For promoting cleanliness and healthfulness in the city the cleaning of streets and removal and disposal of sweepings and garbage occupy a position second in importance to drainage and sewerage only. Street-paving should also be mentioned just here, not only because thorough cleansing is possible only where there is good pavement; but also because a properly constructed pavement is an integral part of the drainage system, leading away the rain-water, etc., and preventing the contamination of the ground with disease germs. Street-cleaning aids the work thus begun by street-paving and, further, prevents the contamination of the air by the dissemination of the disease-breeding foulness of the streets. Recognizing the importance of this branch of municipal activity, the Germans have given careful study to the problems presented and have developed a science of street-cleaning. The cleaning of the streets formerly was—and in some cities still is, more or less—in private hands; but this does not mean that the cleaning was left to private initiative, for regular times for cleaning and regular rules to be followed were enforced. Disadvantages recognized in this system, however, have led to a gradual municipalization of the work. Street-cleaning as undertaken by the German municipalities is a business, not a charity, be it understood.

Promptness and thoroughness in doing the work, and relative saving of time and money, are some of the advantages of centralized municipal street-cleaning. A central bureau does the office work and has general direction of the whole department. For the practical execution of the work the city is divided into districts. In charge of each district is a superintendent with a force of workmen organized into "gangs" and "flying columns." Each district has a central depot in which are the office of the district superintendent, and housing for the various implements, tools, sprinklers, sweepers, collecting wagons, carts, etc. Uniforms—or, at least, uniform caps—are provided for all connected with the work. In Dresden the general director of the department and the twelve district superintendents are salaried municipal employees; the workmen—467 regularly employed in 1901—are paid by the day. The wages for a ten-hour day are 3.20 marks to 4.50 marks. In other cities conditions are similar. Berlin employs, for the most part, youths under twenty-one years of age—large, strong fellows, ready for work—especially for the day work in "flying columns." They work for less than men's wages, but with efficiency. In Hamburg military discipline is maintained in the street-cleaning department. For superintendents ex-sergeants are chosen, and for the men, only those who have had the military training which the German compulsory military service assures.

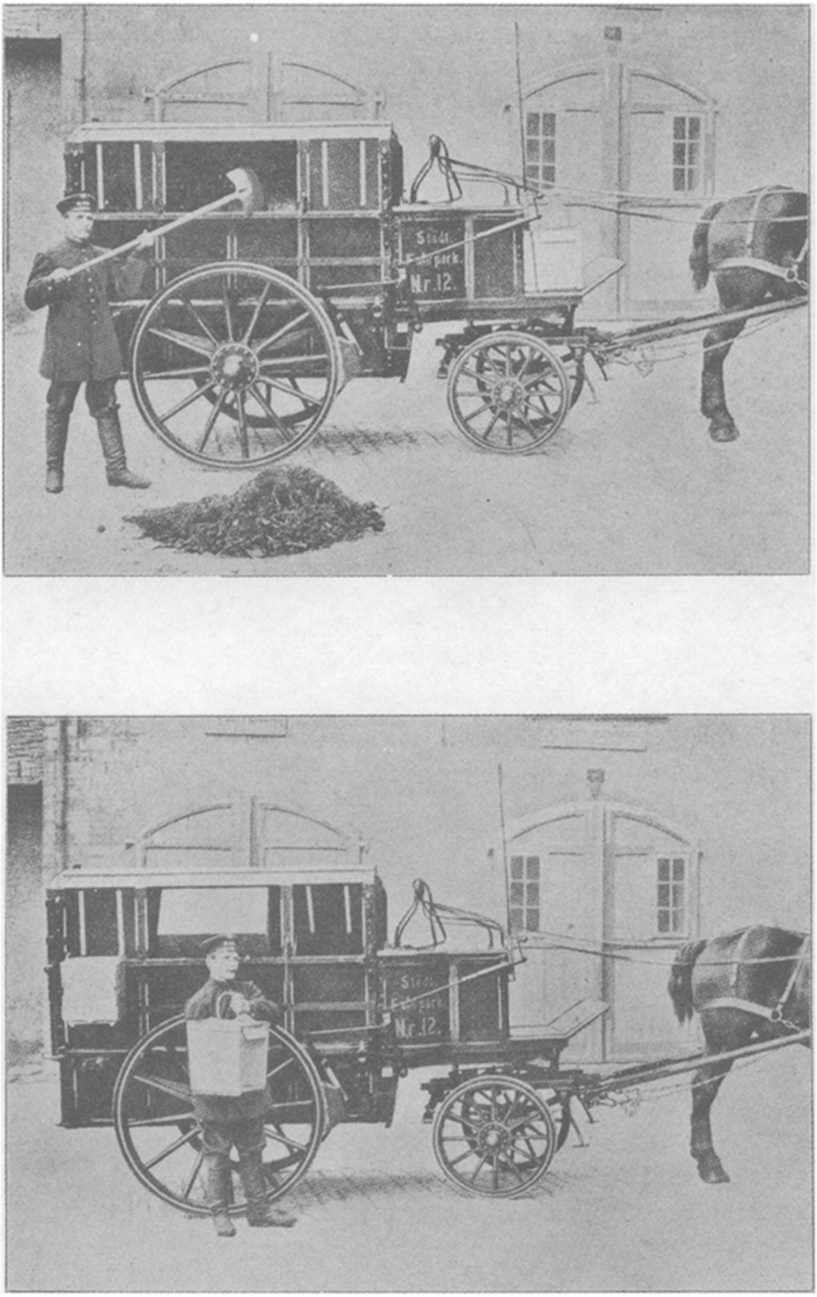
Because of technical and financial advantage to be derived therefrom, there is a tendency toward unification, under a centralized direction of all the branches of city cleaning. Thus the street-cleaning department of Hamburg takes charge of the cleaning of all streets within the city limits, of street-sprinkling, of removal of snow and ice from the streets, of cleaning public lavatories; oversees the collection of garbage (by private contractors), and operates a garbage crematory; further, it cares for the removal of rubbish from the ships, docks, and harbors, and for the cleaning of such cesspools as still exist, with the removal of the material. Dresden's department cleans and sprinkles the streets and squares, removes snow and ice from streets and squares and sidewalks, removes the sludge from the sewer catch-basins under gutters and street-car rails. In Frankfurt a. M. the street-cleaning department and the municipal stables are organized under one department chief. This gives a centralized organization which has full control of the following work: maintenance of macadam streets and walks; cleaning and sprinkling of, including removal of snow and ice from, all paved streets and squares within the city limits; the cleaning of all drainage and boundary ditches (*e. g.*, on municipal land); the cleaning of street gullies and removal of the sludge; the cleaning and maintenance of public lavatories; the removal of street sweepings; the cleaning of the municipal market-halls and removal of the rubbish; the removal of garbage and ashes.

There is a recent tendency to include the flushing of sewers as a part of the work of the street-cleaning department.

Street-cleaning may be considered under two headings: cleaning the streets and keeping the streets clean. The cleaning of the streets is very thorough and of frequent occurrence. In Berlin the chief streets are cleaned six times a week, the majority of the rest, three times, and the remainder—streets in outlying districts where the amount of traffic is minimal—at least once a week. In Frankfurt a. M. the conditions are similar. In Dresden every street in the city is cleaned every day in the week—with the exception of the macadam roads which are not under the control of the street-cleaning department, but are cleaned by the same gang which cares for the maintenance and repair of them. The cleaning of the streets is done at night or in the early morning hours, in order to interfere with traffic as little as possible. Stone-block pavements are cleaned by machines. Frankfurt a. M. employs eight gangs, each consisting of fifteen men, with one sprinkling wagon, two street-sweeping machines, and two collecting wagons. Each gang is in charge of a boss (*Rottenführer*) and his assistant. The sprinkling wagons start out at 9:30 P. M., the sweeping machines at 10 P. M., the collecting wagons at 10:30 P. M. The men begin work at 10 P. M. and work, with a pause of an hour and a half, until 8 A.M. In Dresden the cleaning is done between 4 A. M. and 3:30 P. M.; in winter, 5 A.M. and 4:30 P. M. The chief thoroughfares are all cleaned during the first five hours of work, so as to be clean before heavy traffic begins. The street cleaning department of Dresden exhibited a most interesting and complete equipment of machines, utensils, and tools. This department uses interchangeable sprockets on the sweeping machines, and is thus able to raise the gear as the brushes are worn down. The more rapid the revolution thus given the brushes makes the old ones clean as thoroughly as do new ones. Eighteen-centimeter brushes can thus be used advantageously until they are worn down to five-centimeters, giving an average duration of 150 working hours to the brushes. Dresden saves 4,000 marks a year by thus using up the brushes. Asphalt and wood-block pavements are washed. They are first swept by hand in Dresden, and then thoroughly soaked by sprinkling wagons, leaving the pavement covered with a soft mud which is scrubbed away to the curbing. The more fluid part runs into the sewers, and the remainder is collected in handcarts. In the busiest thoroughfares this cleaning operation takes place every night, except during frosty weather. Dresden is able to continue the work even when the temperature is slightly below the freezing-point, because she dissolves coarse salt into the water in the sprinkling wagons. An important exhibit made by one of the industrial firms was a full-sized model of a machine to take the place of the hand-workers in the scrubbing of asphalt and wood-block pavements. It is a combination of sprinkler and cleaner. Behind the sprinkler is a rotating rubber "brush" operated by sprockets and chain, as is the brush of an ordinary street-sweeping machine. This does the work of three men. Macadam, and stone-block pavements when too uneven to be swept thoroughly by machine, as well as sidewalks are swept by hand. In most cities the cleaning by hand is done less frequently—usually two or three times per week and by daylight.

Keeping the streets clean is, rightly, considered as important as cleaning the streets. The enforcement of laws against littering the streets is, perhaps, especially rigid in Dresden, where even the shaking of a dusting-cloth out of a front window is punished! The advantage of these preventive measures is, however, very noticeable; and the people are already quite in the habit of "helping to keep the city clean," so that their carefulness has ceased to inconvenience them. Moreover, it is the careful, constant work of flying columns during the day which makes the streets presentable, and which makes possible the thorough, rapid cleaning at night. Permanent attendants stationed in certain streets, or flying columns, remove all refuse and manure from the pavements. During wet weather, when a thin coat of watery slime makes the pavements unsafe, they are scrubbed as after a washing. The same group of men has charge of strewing coarse sand, or fine gravel, to give horses a footing on the smooth, slippery pavements.

In Frankfurt a. M. the sidewalks are cleaned by the landlords



THE FRANKFURT WAGON.

under police direction—as in most cities. The regulations require the cleaning of sidewalks twice a week and sprinkling twice a day, the removal of snow, and the strewing of some such material as sand or ashes during icy weather. Upon request, however, the street-cleaning department undertakes this work—except the strewing of ashes—at low rates. Berlin and some other municipalities clean the sidewalks, but leave to the landlords the removal of snow and ice, and the strewing of ashes, as above. Dresden is the only municipality which embraces, as one of the regular duties of the street-cleaning department, the cleaning of the sidewalks, including removal of snow and ice.

The sprinkling of the streets varies according to weather and season. On dry summer days the chief streets are sprinkled four or five times per day; all others—in Frankfurt a. M., for example—at least twice a day. In the same city, asphalt streets are no longer sprinkled at all during the day, for the thorough cleansing which they receive renders sprinkling unnecessary.

The refuse and litter swept up by the street cleaners is loaded into handcarts—in Dresden, for example—and carried to collecting points, whence it is carted away by contractors. In Frankfurt the collection of sweepings is made immediately by wagons from the municipal stables. In case the use of handcarts, or of a small number of dump carts, should strike one as being ludicrous, one must remember that the streets are cleaned so regularly and so frequently that no great amount of material is allowed to collect, even where the amount of traffic is great.

After a snowfall emergency rules, carefully worked out, go into effect. The number of districts of the street-cleaning department is immediately increased by subdivision. The working force is enlarged by the employment of extra men—from other city departments, as well as men seeking work. One or two of the regular sweepers are placed in charge of each of these subdistricts to direct the extra men. The Dresden department employed as many as 2,105 extra men in a single day in 1901. Attention is first turned to the sidewalks and street crossings, then to the principal streets and the streets through which street railways run. The snow is cleared from the middle of the street and collected along the sides, whence it is loaded into wagons to be carted away. The snow thus collected is usually dumped into the river. Several cities which have swiftly flowing trunk sewers have special shafts for dumping the snow into the sewers. Transportation is thus minimized, and the work of clearing away the snow is greatly facilitated. Halle and Wiesbaden exhibited photographs of such snow shafts.

The collection of garbage is still, in many cities, given over to private contractors, who are, however, bound to observe the police regulations. In Frankfurt this activity is municipalized. Ashes and garbage are collected in covered wagons three times a week, between 10 P. M. and 7 A. M. The collection of refuse from public and semi-public buildings, such as hospitals, hotels, restaurants, etc., is not included in the municipal service. The department does, however, undertake this work, as well as removal of rubbish and refuse of all sorts, at the rate of 1.85 marks per cubic meter. Full-sized models of various types of garbage wagons were exhibited. The effort to present a dust-proof wagon has produced many curiosities. Great, cumbrous, complicated, expensive machines, some of them are. Most of them were exhibited by industrial firms; but exhibits were also made by Elberfeld, Frankfurt a. M., Kiel, and Cöln. The Frankfurt wagon[1] is especially worthy of mention because of the many good points which it presents. Strength, simplicity, and ease of manipulation are its chief advantages. It is adapted to have patent garbage cans used in connection with it, but can also be used for the collection of street-sweepings. The wagon box can be kipped for dumping, can be raised from the wagon bed for loading into boats, or into the receiving-room of a crematory, or can be loaded onto a special street-railway truck in order to be transported to a distant dump or crematory.

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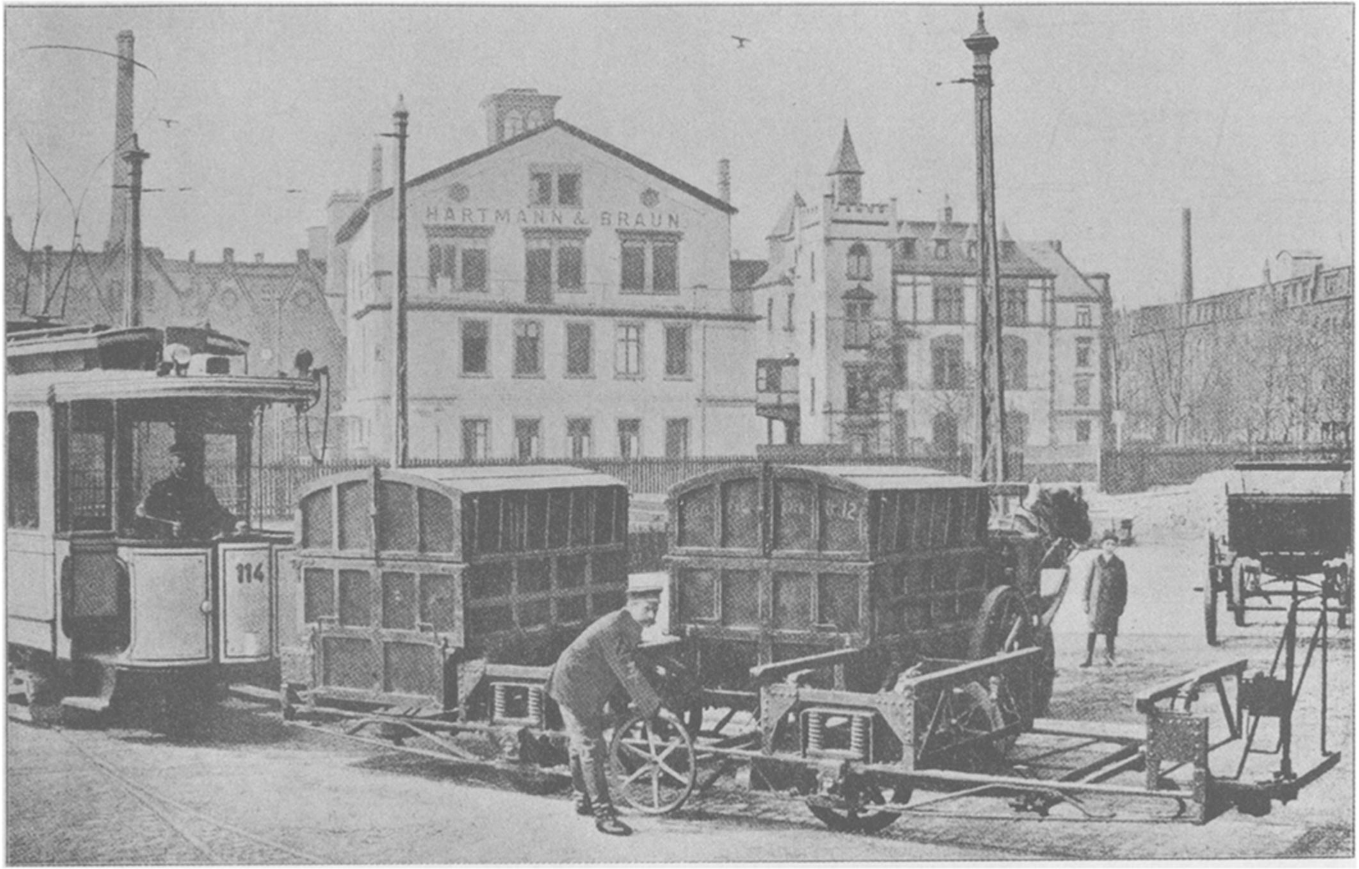
[1] The accompanying illustrations are from a descriptive pamphlet published by the Frankfurt department of public works.



LOADING WAGON BOXES ON TO STREET-RAILWAY TRUCK.

The entire mechanism is so simple that the driver alone can attend to the collecting and the dumping or reloading without help from a second person. This permits of the direct transportation of refuse from the house to the dump. The smaller municipalities still find it advantageous to use the refuse for fertilizer and for filling-in material. As Frankfurt is, however, already finding increasing difficulty in locating dumps, she is investigating the question of cremation of garbage. Hamburg possesses the only large garbage crematory on the continent. The plant, modeled upon the English crematories, was erected in 1895 at a cost of over a half-million marks. Within six years the municipality was able to cremate 1,000 kilograms of refuse 17 pfennigs (*ca.* 3½ cents) cheaper than she had formerly paid for carting away to dumps. Garbage, ashes, street-sweepings, and other refuse are all emptied into the furnace-room and gradually fed into the fire, which requires no other fuel. The large proportion of burnable material—paper, wood, partly consumed coals, etc.—makes it advisable to burn all the material without previous separation. The incombustible material, after being broken up and sorted, is used for building purposes—filling-in, roadbeds, foundations, etc. Wiesbaden has just built a similar crematory, though on a smaller scale; and both Dresden and Frankfurt a. M. are contemplating the advisability of doing likewise.

A further point which may be included here is the disposal of dead animals, animals killed in the pound, animals with contagious diseases, as well as of confiscated meat and fish. The bodies are cut up and reduced through steaming in kettles. The larger kettles in the Dresden establishment are for reducing animals with contagious diseases without any previous preparation. The heat destroys all disease germs. The grease floats on top and is skimmed off by suction pumps and purified; the remainder is dried and ground to a powder, to be used as a fertilizer. The München establishment is located in the woods twelve miles from the city. It contains quarters for the superintendent, with stables for the horses and cattle, separate stabling for diseased animals, and a pound for dogs and other impounded animals. The bodies are reduced to grease and fertilizer, as in Dresden.

Smoke prevention.—Associated with street-cleaning in the work of keeping the air as clean and healthful as may be, is smoke prevention. Over forty industrial firms exhibited various fuels and appliances for the prevention or consumption of smoke. Complete combustion was the end in view, whether it was to be attained by good fuel or by proper stoking, or both. Mechanical stokers, automatic stokers; various sorts of grates, arranged in steps, cooled by a system of water pipes, etc.; improved drafts, and many other appliances were to be seen in full-sized models, and some in operation. Two municipalities, München and Dresden, have smoke-inspection departments which presented small exhibits. The Dresden smoke inspector and his assistants are supplied with cards showing various proportions of black and white. The gray and gray-black patches on the cards are to be compared with smoke columns issuing from chimneys of factories and dwelling-houses, and when the smoke density is reported as excessive the offender is fined. Ignorance as to the proper manner of firing is recognized as, in large measure, responsible for the smoke nuisance; and consequently the department issues rules for firing. It must, however, be frankly admitted that such rules, helpful and necessary though they be, are at best only suggestive, for inspection of firing in private houses is impracticable. Nevertheless, there might be deduced from this the idea of municipal examination of firemen and stokers in large establishments, as to their knowledge of proper firing. The Dresden department requires, further, regular monthly chimney-sweeping. It will be seen that the aim is to prevent as large a part of the smoke nuisance as possible, even though the absolute prevention of smoke is not yet possible.

Disinfection.—This very important social function for limiting the field of infectious diseases is not yet fully municipalized. Berlin, Cöln, Hamburg, and Bremen have full service. Several other cities have disinfecting establishments, as Dresden, Halle, Stettin, Frankfurt a. M., and Strassburg. For the disinfection of bedding, clothing, etc., the dry-heat process has been proved ineffectual, and has been superseded almost universally by steam disinfection. For the disinfection of dwellings, mechanico-chemical and sulphur processes have been found inadequate, except where the furnishings are very simple. Even under these conditions, disinfection by means of formalin (40 per cent. solution of formaldehyde) is considered the best and surest. Persons with infectious diseases found in small apartments or in tenements are removed immediately to the hospitals for contagious diseases; and bedding, clothing, and small movables are taken to the disinfecting establishments. The rooms are then disinfected by carefully trained men. The Dresden disinfecting establishment is the only one where shelter is provided for the people whose only living-room is to be disinfected. In these cases promptness and thoroughness are necessary to prevent the preying of the disease upon the poorly protected neighbors.

Food inspection.—A matter of intimate concern to the German municipalities is the thorough inspection of all food-stuffs. Such inspection requires chemical and bacteriological analyses. These are made in the well-equipped municipal laboratories. Dresden presented an interesting exhibit of various laboratory apparatus. Milk inspection, as in every modern health department, is given a very prominent place because of its very close connection with the public health, and with child-life in particular. A popular exhibit made by Dresden showed vessels holding stated amounts of the most important ordinary food-stuffs, and beside them the proportionate amount of nutritive matter in each. A second exhibit presented various foods together with imitations of the same. Sometimes examination shows gross adulteration, as the following examples from the Breslau exhibit present: "powdered chocolate" adulterated with vegetable starch, then brought up to standard color by the addition of powdered sandal wood; ginger cookies glazed with mica; white pepper corns produced by rolling black ones in clay; further, cigars whose wrapping "leaf" was made of brown, wood-pulp paper lightly dusted with tobacco. Some further services rendered by the municipal laboratories may be mentioned, namely: the extraction of petroleum from charred wood, to prove the incendiary origin of a fire started for the sake of obtaining insurance; the analysis of drinking-water, to guard against impurities therein; the analysis of sewage for the sake of determining the proper disposal thereof; as well as the analysis of river water at various points above and below a city, as made at Cöln, for example, to discover the degree of pollution of the river by sewage and the power of the flowing stream to purify itself; further, the examination of the quality of various objects bought for municipal use, such as building materials, asphalt, paints, and lubricants, among others; moreover, free physiological examinations for doctors who suspect cases of severe or contagious diseases, as well as regular service for the hospitals; the study and preparation of disinfectants, and inspection of the disinfecting establishments; the experimental study of the amount of dust in schoolrooms as influenced by weather, ventilation, kind of flooring, method of cleaning, and of the effect of "dustless oil" for oiling the floors.

Municipal abattoirs.—Cattle markets and slaughter-houses were exhibited by thirty municipalities. Concentration and municipalization of stock-yards and slaughter-houses are held to give control and better facilities for inspection. The live-stock markets are, in some cities, operated by the municipality, and in others, under municipal concession. In either case there is general oversight on the part of the municipality and inspection of the animals by municipal officials. The slaughtering of the cattle is, likewise, either undertaken by the municipality for a compensation, or performed by individual butchers who pay a rent for the use of the slaughter-house, including light, heat, hot water, etc. There is inspection by municipal officials of the slaughtering process and of the dressed meat. The slaughter-houses are usually large open halls, though some—as in Berlin, for example—are divided into separate rooms for the use of individual butchers. The latter plan is less acceptable to the authorities than to the butchers, for the inspection of the work cannot be so readily nor so carefully made.

Municipal markets.—Vegetable and provision markets, more or less under municipal direction or control, are a direct inheritance from the past. The market-halls, which most municipalities now provide, are the market-places of modern times for both wholesale and retail trade. The markets have a place of their own, and exist side by side with the stores and shops without supplanting the latter. Their advantages are, from the standpoint of the community, the excellent opportunity for food inspection which they offer, and, from the standpoint of the individual, the cheapness of a large and varied assortment of fresh goods offered for sale.

Fire-fighting.—The careful formulation of building laws and the thoroughgoing enforcement of them make for good construction of buildings, which is, of itself, a preventive measure. One of the recognized duties of the fire department in Dresden and other Saxon cities, for example, is to render an opinion on plans submitted to the building department. Further duties, aside from those usually pertaining to such departments, are: the overseeing of the prescribed periodical chimney-sweeping; the inspection of the safety of large stores, churches, theaters, and places of amusement; the inspection of stores of spirits and of petroleum; and the testing of petroleum. The fire department is well organized and under strict military discipline. Chemnitz exhibited a very comprehensive collection of objects used in the training and education of her firemen, as well as an interesting collection of models of historical apparatus. Suits resembling those worn by divers as well as various fire-proof helmets, gloves, face-masks, etc., were exhibited. The very formidable-looking suit of the Kiel department is water-proof, rather than fire-proof. A sprinkling apparatus attached to the fireman's helmet and connected with a lead of hose envelops the man in a protecting sheet of water. The Leipzig suit is supplied with an oxygenator, rather than with a pipe leading to an air-pump outside the building, as is usually the case. The fire-alarm telegraph systems are well developed, and the best ones are supplied with modern American apparatus. Speed is usually lacking, both in getting away from the engine house and in going to the fire. There is noticeable, however, a more systematic arrangement in the newest stations in Berlin and Kiel which is suggestive of the American plan. Automobile engines, as used by Hannover and adopted by Dresden, have greater speed and are said to be more economical. The steam-driven engine is, moreover, ready to pump water as soon as it arrives at the scene of the fire without waiting to unhitch or to get up steam. Frankfurt a. M. exhibited a model of its pneumatic ladder; and Bremen, models and photographs of its fire-boats. The fire department of Dresden exhibited a number of plans of action for attacking fire in public buildings and in other buildings thought to be especially liable to take fire. The plans of the buildings include the positions of the nearest water hydrants and of the most advantageous points from which to fight the fire. Dresden possesses only two steam fire engines, and these for emergency use only, because the high-pressure water supply is sufficient protection. Breslau exhibited a model of the municipal theater in which the smoke ventilators over the stage are opened mechanically by the lowering of the iron curtain. To avoid danger from highly charged wires of the electric street railways, the Dresden fire department is able to make a short circuit by means of an insulated cable, of which a full-sized model was exhibited, which connects the overhead wire with the track.

Police.—The protective police are under state, rather than municipal, direction, but presented an exhibit in a special department of the exposition. The organization embraces a number of departments, some of which may be noted. The political police has oversight of the press, clubs, meetings, political criminals, etc. The criminal police has charge of crimes and offenses in so far as they do not come more directly within the scope of one of the other departments. The Dresden police made an exhibit of the dactyloscopic process of identification, together with the system of filing the finger prints. The traffic department has charge of licensing and inspection of cabs, carriages, omnibuses, and street railways, of bicycles and automobiles, and also of direction and licensing of commissionaires. Another department has charge of licensing amusements, theatrical presentations, lectures, etc., together with censorship of the same, and the licensing and direction of cafés, restaurants, beer halls, etc. The registration department catalogues all persons in the police district, whether permanently or transiently. Worms uses the loose-leaf system for this register. Dresden uses a card catalogue in the district, and a booking system at the central office. Besides the personal catalogue, there is a house register of all persons within the house, including servants, sub-renters, lodgers, and visitors. Another department has charge of ordinary police service and protection. There are also the *Sittenpolizei*, the lost-and-found department, etc. Under the direction and control of the municipality are the sanitary police, the health department police, the *Gewerbepolizei*, in charge of various trades, aud conditions produced by them, the markets police, etc. It will be noted that the word "police," as here used, is a very inclusive term. Thus there are, as well, the "fire police," the "public-works police," etc.

Cemeteries and crematories.—There are both social and sanitary reasons for municipal direction and control of cemeteries. Their location, the condition in which they are kept, their surroundings, and the possibilities for contamination are points closely connected with the public welfare. Hamburg is an example of the municipalities which attempt to beautify their cemeteries. Berlin and Cöln actually exhibited their cemeteries, along with parks and public gardens, under the general title of "institutions for the maintenance and furtherance of public health." Dresden is one of the municipalities which take charge of undertaking and burial. Hearses and carriages, varying from simplicity to elegance, are furnished by the municipal stables. Private undertakers and burial societies exist side by side with the municipal department. The latter, however, offers competent competition at fixed prices, and thus serves to prevent a monopolization of undertaking and the exploitation of the public. The economies of space, hygienic demands, and a growth of rationality and æsthetics are tending toward a popularization of cremation. Cremation societies exist in many of the German cities; and some of the municipalities have erected crematories and columbaria, while others aid the societies by grants of land. Crematories already exist in Gotha, Heidelberg, Hamburg, Offenbach a. M., Mannheim, Mainz, Eisenach, and Jena; and others are projected, or in course of construction, in Bremen, Chemnitz, Leipsig, Dresden, Stuttgart, and Karlsruhe.

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[*To be concluded.*]